國 立 臺 灣 海 洋 大 學
海洋環境與生態研究所 專題討論#

中文題目：東沙島兩處海草床短期碳化學變化之比較：論對海水 pH 緩衝和大氣二氧化碳吸收能力的影響

英文題目：Short-term variability of carbon chemistry in two contrasting seagrass meadows at Dongsha Island: Implications for pH buffering and CO_2 sequestration

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中文摘要

本研究於2015年8月調查位於南海北方東沙島上兩處海草床海水碳化學參數(溶解態無機碳(DIC)、總鹼度(TA)、二氧化碳分壓(pCO_2)和 pH）的日夜變化。研究結果顯示在半封閉的內潟湖中，pH 和 TA 比開放水域的北岸高，pCO_2 則較低。碳化學參數對溶氧以及 TA 對 DIC 關係的分析結果顯示，北岸海草床海水碳化學的日夜變化主要受光合作用和呼吸作用所控制，而內潟湖除受以上兩作用影響外，還受到沉積物中厭氧代謝作用的影響。作者將兩處海草床碳化學參數的差異歸因於水體動力環境不同所致，內潟湖中水體動力能量較低和水駐留的時間較長，有利於沉積物中厭氧代謝作用生成 TA 以及上覆水體中 TA 的累積。TA 的升高會使得 pH 增加和 pCO_2 降低，進而提高了海草床上覆水體緩衝海洋酸化和吸收大氣二氧化碳的能力。此研究結果表明，水體動力環境在調節海草床生地化過程中扮演著相當重要的角色，並可進而調控海草床對海洋酸化緩衝及吸收大氣二氧化碳的能力。

Abstract

The diurnal cycles of carbon chemistry parameters, i.e., dissolved inorganic carbon (DIC), total alkalinity (TA), partial pressure of CO_2 (pCO_2), and pH, were investigated in two hydrodynamically contrasting seagrass meadows at Dongsha Island in the northern South China Sea in August 2015. The results show that the pH and TA were higher and that the pCO_2 was lower in the semi-enclosed inner lagoon (IL) than on the open north shore (NS). The analyses of carbon chemistry parameters vs. dissolved oxygen and TA vs. DIC relationships reveal that the CO_2 dynamics was dominated by photosynthesis/respiration (P/R) alone on the NS but by the combined effect of P/R and sedimentary anaerobic pathways in the IL. We suggest that the observed divergent behaviors in carbon chemistry between the two sites could be attributed to differences in hydrodynamic regimes. The less energetic hydrodynamics

and longer residence time in the IL would be favorable for the occurrence of sedimentary anaerobic TA generation and the subsequent TA accumulation in the overlying waters. The elevated TA may lead to a pH increase and a pCO_2 decrease, thus providing a buffering effect against ocean acidification (OA) and enhancing atmospheric CO_2 sequestration at local scales. The present results demonstrate that hydrodynamic regime may play an important role in regulating biogeochemical processes in seagrass meadows, and thereby modulating their capacities in OA buffering and CO_2 uptaking.

參考資料

Chou, W.C., Chu, H.C., Chen, Y.H., Syu, R.W., Hung, C.C., and Soong, K., 2018. Short-term variability of carbon chemistry in two contrasting seagrass meadows at Dongsha Island: Implications for pH buffering and CO_2 sequestration. Estuarine, Coastal and Shelf Science. 210, 36–44.#